Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

PUBLICATIONS
OF THE
Astronomical Society of the Pacific.

Vol. XXXI. San Francisco, California, December, 1919 No. 184

THE FUTURE OF THE TRANSIT-CIRCLE

By J. E. de Vos van Steenwijk

The importance of the transit-circle has waned considerably during the last fifty years. Much of the work to which it was originally destined has been completed or needs only intermittent attention. Another part has been taken up by special instruments *e. g.* the zenith-telescope. A still greater part has fallen into the domain of photography. So it may justly cause some perplexity if a new program has to be started now and one may feel inclined to think that the activity might be better directed wholly to other instruments. The aim of this article is to show that our transit-circles may be used in more than one way to solve some of the great problems concerning the structure of the universe where other methods will fail.

Before arguing this point I shall briefly review the different tasks that are now incumbent on meridian observers and the amount of work necessary to their completion.

Our fundamental systems, at least for the northern hemisphere, may be said to rest on a sound basis. Altho regular observations will always be needed to maintain them on this height and automatically to increase their excellence, it can hardly be said that an important fraction of the available instruments are needed for this purpose. This part of the work may be left to great and old-established observatories such as Greenwich, Pulkowa and the Cape of Good Hope, because continuity and an intimate knowledge of the instruments used, play such a great part in it.

A second question is the acquisition of an extended body of fundamental proper-motions. The repetition of the A. G. zones and their extension to the South Pole form here the natural solution. But before embarking on such an extensive enterprise it behooves us to investigate very thoroly whether this burden could not be taken off the shoulders of meridian observers also. It has been argued from more than one side that by using a portrait lens and a wide-angle camera the whole repetition of the A. G. Catalog might be completed by a single observatory in a few years, leaving only a few thousand reference stars to be determined by meridian observations. For this last purpose the so-called *intermediate stars* of the Astrographic Catalog, which number more than six thousand in the northern hemisphere alone, and have been chosen with the utmost care, would be amply sufficient and no extra work would be needed.

For comparison stars in micrometrical work the reference stars of the same catalog give all that can be desired.[1].

A new field was opened in 1886 by Kapteyn, who used the transit-circle for parallax determinations. His example was followed by Flint and, after the introduction of the registering-micrometer, by Groszmann and lately by Voute at the Cape. The prospects for this method are judged differently. Courvoisier, who tested it by a re-determination of the accurately known parallaxes of γ, δ and ϵ *Ursae Majoris* (which belong to a well-known moving cluster), concluded that at least the hand-driven micrometer is not to be trusted in this respect. On the other hand Groszmann has strongly advocated the use of the method and has even started a coöperative scheme, of which I believe he is at present the only active member. The question whether or not systematic errors are to be feared here must be fully elucidated. That the accidental errors are greater than in photographic results does not tell much against the method as I should like it to be used.

I should think it an immense advantage if a Durchmusterung for parallaxes by meridian observers were to show photographic and heliometric observers where their energies ought to be directed. If we only succeed in sifting out a small percentage of stars suspected of having measurable parallaxes, the present undesirable method of choosing stars with great proper motions could be abandoned. We must not forget that, while secular parallaxes furnish excellent material for researches into stellar astronomy, the knowledge of our immediate neighborhood depends wholly upon individual parallaxes and is proceeding slowly by the present methods.

I will now develop my suggestion as to a new line for transit-circle research. It is based on the following considerations:

Much insight into the structure of the universe has been gained by the discussion of the relations between proper motion and spectral type. But in the catalog from which these proper motions have been deduced the spectral type was never taken into account, nor indeed could this have been done at the time. The result is that they consist mainly of stars of types I and II, while type III (M) is scarce and types IV (N) and V (O) are almost wholly wanting. In the researches of L. Boss and Kapteyn, for example (Eddington, *Stellar Movements*, p. 167), the number of M stars attains only ten per cent of those of types I and II each, and N and O are absent. Now this is an inconvenience which photography could never remedy. When the plan of selected areas shall be completed, its results again will refer mainly to types I and II. This difficulty is accentuated for the M and N stars by their red color, which renders them so faint on the photographic plate.

---

[1] Except for the Zodiac, for which the Paris Conference has prepared a special catalog.

It seems to me, therefore, that the time has come when we should cease to choose our stars for meridian observations by the criterion of magnitude or apparent place, which are both irrelevant to their constitution or location in the universe, and might properly be termed a non-natural classification. Most happily the new Draper Catalog affords us a wide scope for selecting an observation list based on spectral type and where it fails the color index furnishes a rough substitute.[2]

Granting this point, the first thing must be to supplement our scanty data as to the M stars. The first four hours of the new Draper Catalog contain 483 of them, or nearly two per cent of the whole, so that we may expect that about 4400 M stars will soon be known in the sky. Many of these will be found in the A. G. Catalogs, and for them tolerably good proper motions might be obtained in the near future. The M stars are especially interesting owing to the appearance of the so-called dwarfs and giants. Nothing is known as yet as to the relative frequency of these two among the fainter stars and considerable extension of our knowledge may be expected from more and more reliable proper motions.

For the stars of type N the outlook is decidedly less bright. The Draper Catalog will probably contain only some hundred of them, and the color index is not a sufficiently sharp criterion to distinguish them from the M stars. Indeed, by selecting faint stars with a high color index (as might be done by comparing the magnitudes of the astrographic catalog or the C. P. D. with those of a visual Durchmusterung) we are sure the results will bear almost exclusively on M stars.

---

[2] A first step in this direction are the meridian observations at Kopenhagen of B and M stars by Braae, and of N stars by Nörlund.

A catalog of 166 N stars has been observed by Nörlund at Kopenhagen, who deduced for 144 of them proper motions. Kapteyn discussed these and found a mean parallax of only 0″.0007 with a probable error of the same magnitude. From this it would appear that they are on the whole ten times more distant than the helium stars, which is very interesting owing to their strong galactic concentration. But Nörlund based his determinations on a number of older catalogs which I should hesitate to use for such a refined purpose. He does not give the probable errors of his concluded proper motions, but I fancy that they would considerably exceed the proper motions themselves. I think that his observations form only a valuable material at an initial epoch.

SUMMARY

1. The observing of fundamental stars ought to be left entirely to a few of the greatest observatories.
2. Experiments[3] should be instituted whether or not a repetition and extension of the A. G. zones could be effected with the aid of photography, while the intermediate stars of the astrographic catalog might be used as reference stars.
3. In view of the preceding, meridian work on secondary stars should be restricted to the needs of the moment.
4. A Durchmusterung for parallax by meridian observers has not yet lost its importance.
5. Meridian observations should further be directed into channels where photographic research encounters special difficulties, *e. g.* systematic observations of stars of type M, that are too sparsely distributed for examination by samples as in the plan of selected areas.

POST SCRIPTUM

I have made some counts of the M stars contained in the first part of the Henry Draper Catalog. Of the 483 M stars found, 263 belong to one or more of the A. G. zones, including the Cordoba zone -22° -27°; of the remaining, only 38 inside those zones are not found in the A. G. catalogs. Twenty-six M stars were found among the reference stars of the Perth and Cape sections of the astrographic catalog.

---

[3] Such an experiment has been in progress at the Allegheny Observatory for several years and the results are very satisfactory. The photographic star places are at least as accurate as the older A. G. zone positions, and the cost of obtaining them is much less.—The Editors.